IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Yasaitis
Serial No.: 10/656,850
Date Filed: September 5, 2003
Invention: LIGHT CONVERSION APPARATUS WITH TOPSIDE ELECTRODE

Atty. Docket: 2550/184
Art Unit: 2878
Examiner: Sohn, Seung C.

Commissioner for Patents
Washington, D.C. 20231

DECLARATION UNDER 37 C.F.R. § 1.131

Dear Sir:

I, John Yasaitis, do hereby declare as follows:

1. I am the inventor of claims 1-21 of the patent application identified above, and the inventor of the subject matter described and claimed therein.

2. Prior to April of 2003, I completed my invention as described and claimed in the subject application in this country, a NAFTA country, or a WTO country, as evidenced by the following:

a. Prior to April of 2003, I worked with personnel at Massachusetts Institute of Technology ("MIT," which is located in Cambridge, Massachusetts) to produce prototypes of the invention as defined by the claims (thus, reducing the invention to practice). Black and white photographic images of some of the prototypes are shown in Exhibit A. It should be noted that the images in Exhibit A are magnified. A description of the prototypes also is attached as Exhibit B, which is a group email summarizing some details of the prototypes, testing results, and various design issues. This email was transmitted to multiple parties, including parties at MIT and Analog Devices, Inc. of Norwood, Massachusetts, prior to April of 2003.

b. Also prior to April of 2003, the personnel at MIT, under my guidance, conducted a number of tests on the prototypes described in Exhibits A and B. Those tests included current to voltage tests, area and peripheral leakage tests, and responsivity tests. Waveforms showing the results of those three tests are attached respectively as Exhibit C, Exhibit D, and Exhibit E.

c. I was pleased with the results of the tests because, as shown by the waveforms in Exhibits C-E, at least one of the tested prototypes performed satisfactorily for its intended purpose.

3. As noted above, all activities described in this declaration were conducted in this country, a NAFTA country, or a WTO country.

4. I hereby declare that all statements made of my own knowledge herein are true, based upon available information; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 or Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereof.

Jan. 23, 2006
Date

John Yasaitis

Exhibit "B"

Steven Saunders

From: Yasaitis, John [John.Yasaitis@exchange.analog.com]

Sent:

To: cannon@mit.edu; Potter, David; Ayyagari, Diane; dtdaniel@mit.edu; Braun, Eric; eshed@mit.edu; gbkenney@mit.edu; Molnar, George; jmichel@mit.edu; kwada@mit.edu; Devito, Lawrence; lckim@mit.edu; mbeals@mit.edu; nokster@mit.edu

Cc: Meisenhelder, Bob; OMara, Bill; Scharf, Brad; Hyde, Chris; Core, Craig; diadiuk@mit.edu; Ward, Geoffrey; Davis, Greg; Steigerwald, Jake; Doscher, Jim; Felton, Lawrence; Judy, Michael; Real, Peter; Fuller, Sam; Deliwala, Shrenik; Miao, Tremont

Subject: ADI-MPC Meeting Notes

The attendees at the meeting were: Jurgen Michel, Diane Ayyagari, Dave Danielson, Douglas Cannon, and John Yasaitis.

Notes from the meeting are as follows:

- **We now have good Ge Photodiodes !!** - Data was presented on the DC I-V diode characteristics and spectral response of the first set of Ge photodiodes fabricated at MIT for ADI. These were blanket layer Ge devices with the top electrode defined by an oxide window and n+ implant doped poly Si to form the top electrode. The p+ substrate formed the opposite collection electrode; and the p+ contact. The n+ poly led to an "off-diode" probe pad for the n+ contact. Reverse diode dark currents were about 2x lower then those measured a year ago on mesa etched Ge diodes fabricated at MIT. The uncalibrated spectral response was similar to previous data with a long wavelength cutoff above about 1.6um. Test results were similar over the population tested (all diodes tested were functional) which also included large and small diameter devices. A curve fit of the I-V data indicated that edge leakage began to be significant (~30%) at diode diameters of 10um or less. However, more characterization data is needed. Diodes tested on Ge (about 1um thick) grown at 700C and 800C gave approximately similar results.
- The Ge reactor has also finally started to produce good Ge films again - last week was a good week for Douglas!! We are now proceeding with new 4" lots to fabricate Ge mesa diodes. This should now proceed quickly as all necessary recipes and masks have been proven out, and several graduate students are now available to process wafers. For the next few lots it was decided to fabricate both blanket and selective mesa diodes until we better understand the process. Material will be run at growth temperatures of 600, 700 and 800C to evaluate the effect of growth temperature. The next run, however, is being run at 500C to compare to the Unaxis process. Douglas will run 2um epi for now as this provides better defect densities and photo responsivity.
- 6" wafers with and without oxide rings for selective epi are now being prepared for Unaxis. We would like to start another demo run at Unaxis once we have some confidence that they can produce Ge epi comparable to the MIT process. We are still waiting for AFM Ge surface roughness data on both Unaxis (335C seed film layers) and older MIT epi (selective and blanket) to determine if the average roughness and epi pit density and depths are comparable. We also are waiting for TEM data to further characterize the defect pits in earlier Unaxis epi. Finally we are also waiting for 500C Ge epi out of the MIT reactor to compare to the Unaxis epi which is grown at 500C, or less, due to a reactor flange design constraint. With all this data in hand we should be able to decide on the probable best process to run at Unaxis. This will then hopefully provide a source of Ge epi for 6" wafer processing.

  The MIT Unaxis reactor installation is still being held up by MIT's decision on where to locate it. The latest idea is to put it in a room owned by the physics department on the first floor of Bldg 13. Since this location already has much of the needed facilities, installation would be quicker and cheaper than a previously planned location in Bldg 13.

- Douglas presented a list of ADI supplied Ge diode masks now at MIT, and suggestions for changes to improve alignment tolerances. Recent SEM's have also indicated that diode edges aligned to the

(100) direction have a 25 degree sidewall (vs. 57degrees as previously thought). This must also be taken into in the overlap of the mesa diode n+ implant window by oxide ring edge which defines the bottom edge of the Ge mesa. Douglas' preference is to increase the inside diameter of the oxide ring. Douglas will document the masks we have, and talk with Dave Potter about new masks for improved alignment tolerance, and contact and metal masks for response time measurements. We decided to review the mask situation at next week's meeting.

- Jurgen said he has ordered Ge wafers to evaluate Ge surface passivation treatments (e.g. oxide, oxynitride) by bulk recombination lifetime measurements to develop a Ge diode sidewall passivation.
- Dave Danielson, Nok, and a new student Jifeng Liu as well as Douglas are now available to assist in wafer processing of the Ge photodiode lots. After some unit process training this should substantially speed the progress of our Ge diode lots.
- Dave reported that proper AFM evaluation of the Ge diodes was time consuming. This included taking scans to determine RMS roughness away from defects, line scans to characterize the pit like defects, and overall peak to peak roughness. In addition optical micrographs are needed to characterize defects. We therefore decided to prioritize this work, as some of it is more essential for development of a Unaxis process. For now Dave will concentrate on three MIT wafers - 1) 700C blanket and selective epi diodes, 2) 500C MIT blanket Ge, 3) Unaxis Ge epi with a 335C seed (as used at MIT).
- Douglas reported that there was one process issue left for the Ge diode process flow. The pre-clean prior to poly deposition over the Ge diodes has been modified to remove the peroxide which etches Ge. There is now a concern at MTL that this clean will not adequately remove residual organic material. Douglas will get the modified clean recipe to John who will then try to resolve this issue with MTL.
- Diane reported on a comparison of Ge thickness measurents for several 2um Ge films on p+ substrates. Three methods were compared: RBS measurements through MIT, IR reflectivity at BU, and FTIR at ADI. The results were: 1) RBS - 1.75um, 2) IR reflectivity - 1.91um, and 3) FTIR - 2.05um. These are reasonably close (e.g. +/-7.5%), especially considering they were taken on different wafers from the same run. The optical measurements also have some assumptions on optical constants. It was decided to use TEM to determine absolute thickness to calibrate some of these techniques.

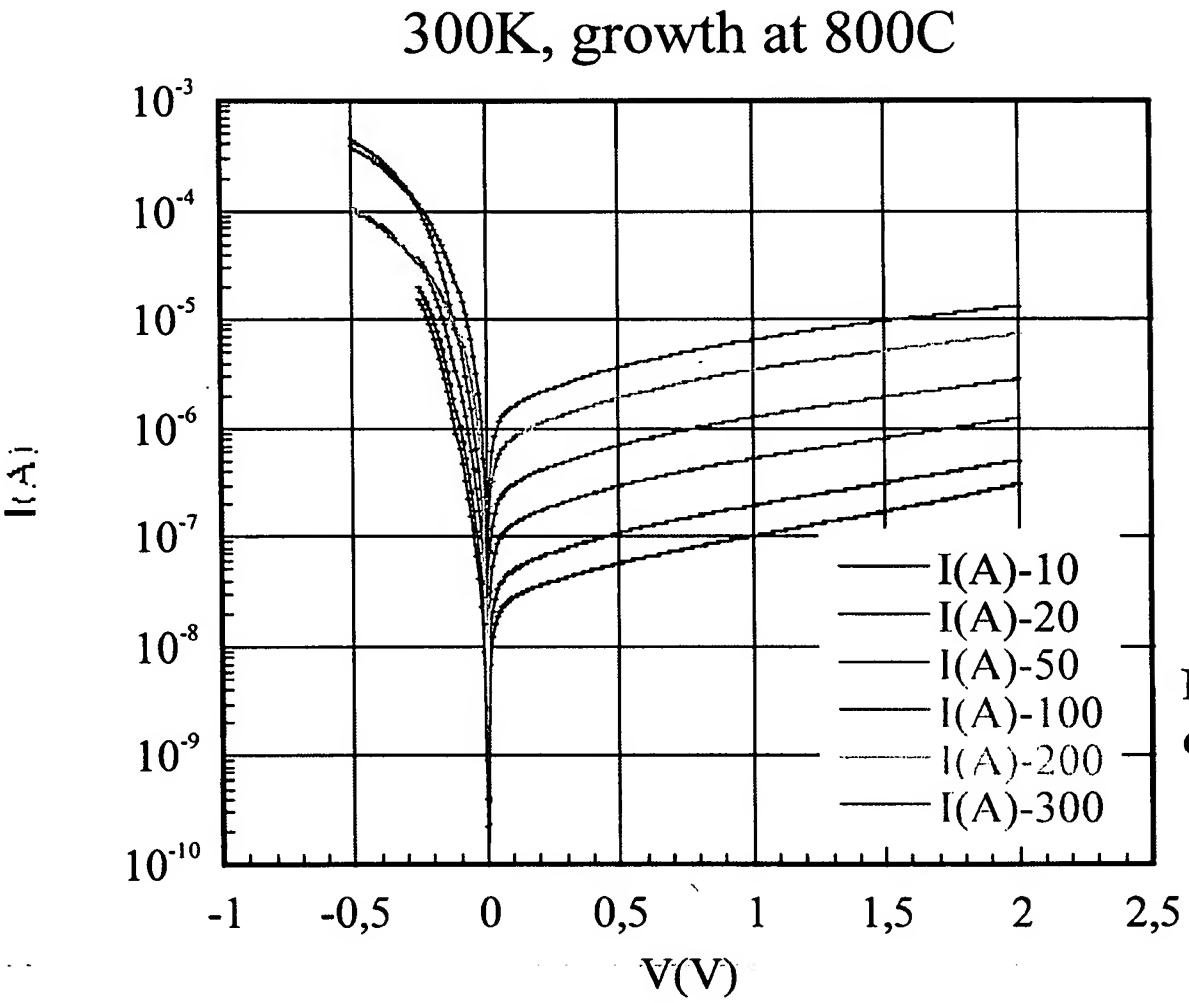
Action items for next week:

- Run 500C Ge epi for comparison to Unaxis material.
- Provide 6" wafers with oxide rings and bare wafers for the next Unaxis epi run.
- Obtain AFM and epi defect data on the 4 samples discussed above.
- Douglas will be prepared to discuss the metal masks at the next meeting.
- Douglas will get the poly pre-clean recipes (standard and for Ge wafers) to John who will review them with MTL.

John

Exhibit "C"

I/V Characteristics of Ge Diodes

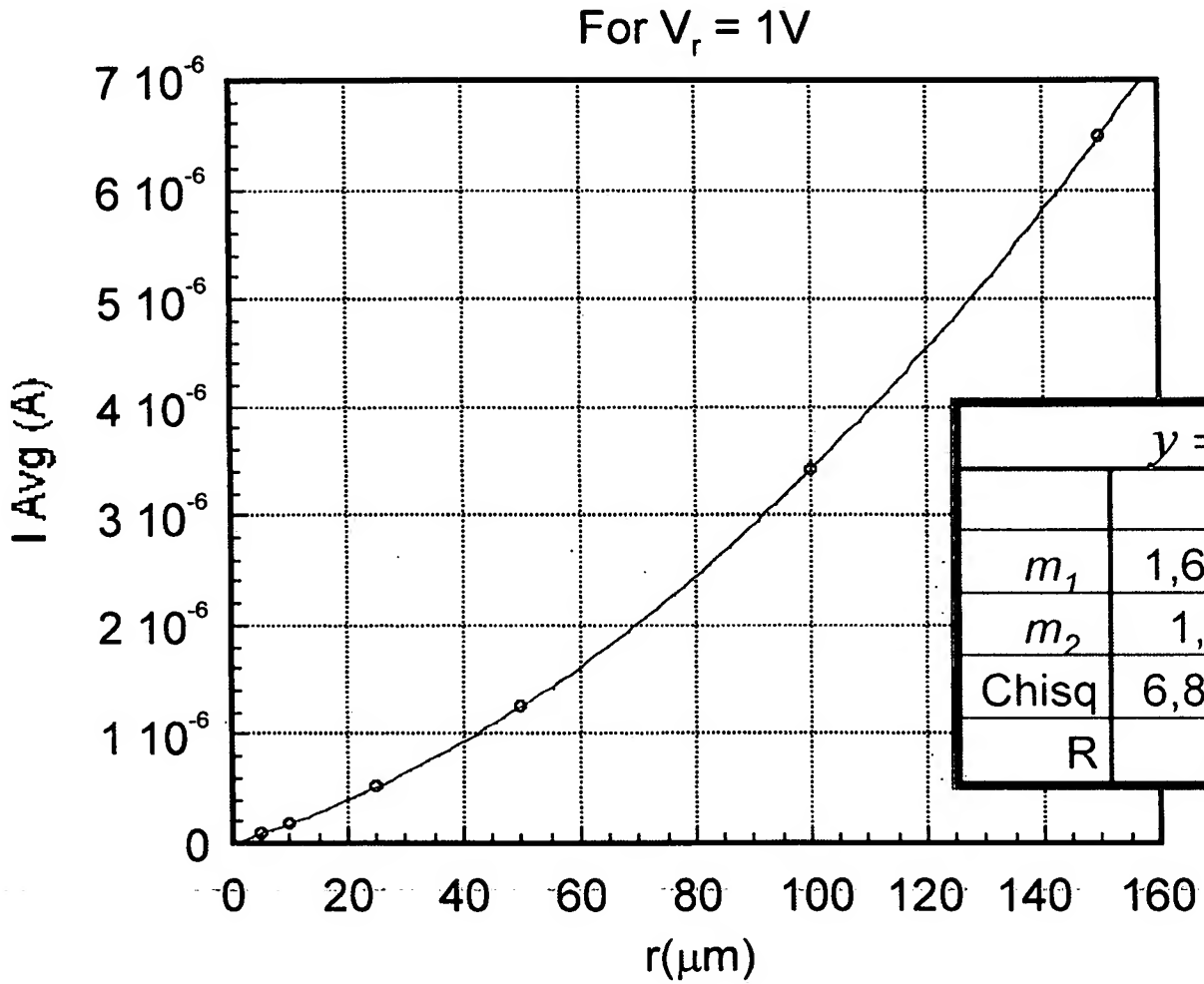


Numbers denote device radius.

MIT, confidential

Exhibit "D"

Area and Peripheral Leakage



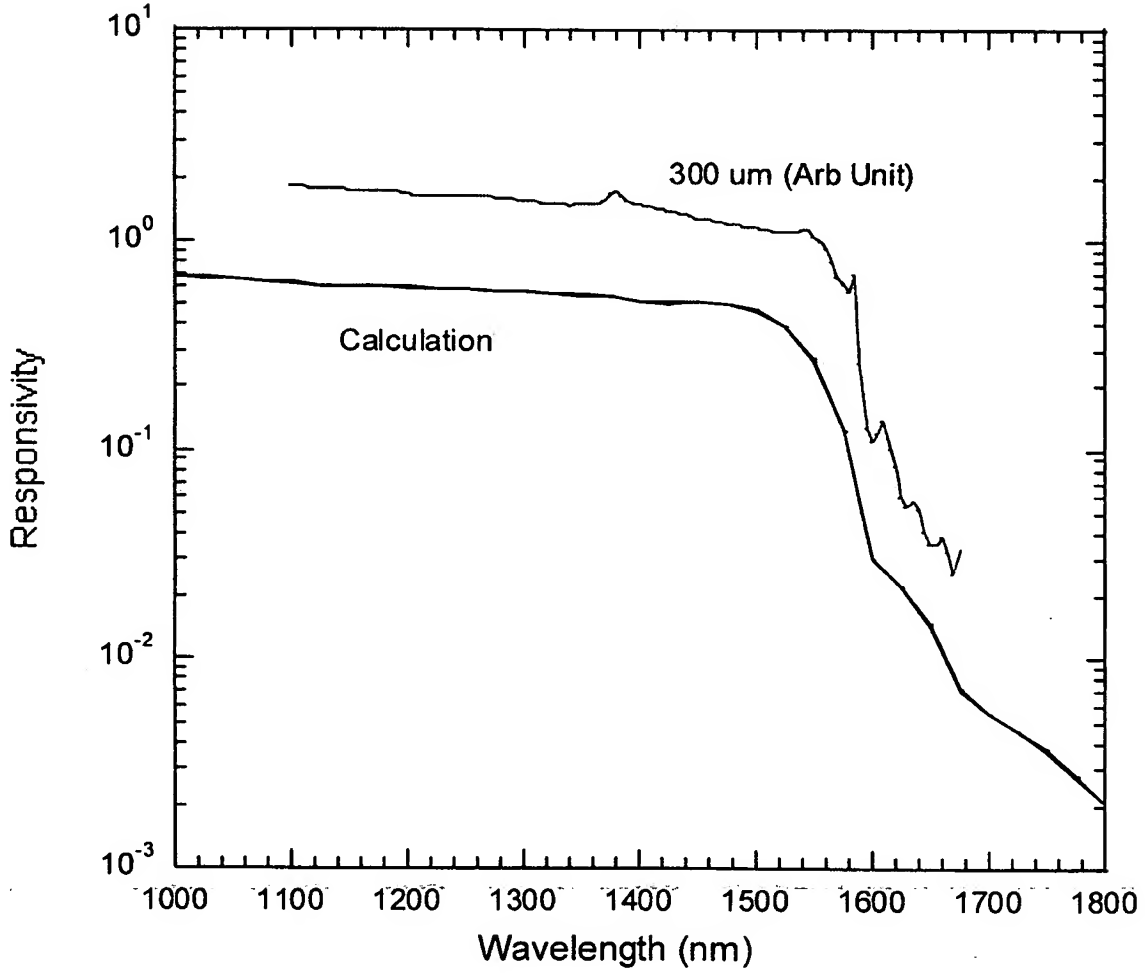
Leakage current has two components, area related leakage and periphery related leakage.

$y = m_1 x + m_2 x^2$

	Value	Error
m_1	1,6096e-08	2,6357e-10
m_2	1,811e-10	2,013e-12
Chisq	6,8467e-16	NA
R	0,99999	NA

Exhibit "E"

Responsivity of Ge Diodes



Responsivity is currently measured in arbitrary units. We are in the process to determine the responsivity in Amps per Watt.

From the INTERNATIONAL SEARCHING AUTHORITY

To:
BROMBERG & SUNSTEIN LLP
Attn. Saunders, Steven G.
125 Summer Street
Boston, Massachusetts 02110-1618
UNITED STATES OF AMERICA

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference 2550/184 WO	Date of mailing *(day/month/year)* 17/12/2004
International application No. PCT/US2004/028800	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
Applicant ANALOG DEVICES, INC.	International filing date *(day/month/year)* 03/09/2004

1. [x] The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

   When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

   Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Fascimile No.: (41-22) 740.14.35

   For more detailed instructions, see the notes on the accompanying sheet.

2. [ ] The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. [ ] **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   [ ] the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

   [ ] no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90*bis*.1 and 90*bis*.3, respectively, before the completion of the technical preparations for international publication.

   The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until **30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

   In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

   See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the International Searching Authority European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Gennaro Cappiello

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international pbulication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the International application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When? Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How? Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped),whether

(i) the claim is unchanged;

(ii) the claim is cancelled;

(iii) the claim is new;

(iv) the claim replaces one or more claims as filed;

(v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."

2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."

3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."

4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international appplication is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
2550/184 WO		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/US2004/028800	03/09/2004	05/09/2003
Applicant		
ANALOG DEVICES, INC.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language,** the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
      [ ] The international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
   b. [ ] With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. [ ] **Certain claims were found unsearchable** (See Box II).

3. [ ] **Unity of invention is lacking** (see Box III).

4. With regard to the **title,**
   [X] the text is approved as submitted by the applicant.
   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**
   [X] the text is approved as submitted by the applicant.
   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regards to the **drawings,**
   a. the figure of the **drawings** to be published with the abstract is Figure No. 1
      [X] as suggested by the applicant.
      [ ] as selected by this Authority, because the applicant failed to suggest a figure.
      [ ] as selected by this Authority, because this figure better characterizes the invention.
   b. [ ] none of the figures is to be published with the abstract.

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01L31/101

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 414 275 A (SUGAWA SHIGETOSHI ET AL) 9 May 1995 (1995-05-09) column 2, line 48 - column 7, line 52; figures 2,3a	1-5, 7-12, 16-20
Y	US 5 556 423 A (CHOW ALAN Y ET AL) 17 September 1996 (1996-09-17) column 3, line 28 - column 11, line 12; figures 1-4,6,8,9,11	1-5, 7-12, 16-20
A	US 2002/145139 A1 (MA EUGENE Y ET AL) 10 October 2002 (2002-10-10) the whole document	1-20

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 December 2004	17/12/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Boero, M

1

Form PCT/ISA/210 (second sheet) (January 2004)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2003/022466 A1 (BOSCO BRUCE ALLEN ET AL) 30 January 2003 (2003-01-30) the whole document	1,6
A	US 6 278 102 B1 (JOHNSON JEFFREY B ET AL) 21 August 2001 (2001-08-21) the whole document	1-20

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5414275 A	09-05-1995	JP 4261071 A	17-09-1992
		CA 2059176 A1	12-07-1992
		DE 69211164 D1	11-07-1996
		DE 69211164 T2	21-11-1996
		EP 0494691 A2	15-07-1992
US 5556423 A	17-09-1996	US 5397350 A	14-03-1995
		AT 213928 T	15-03-2002
		AU 674084 B2	05-12-1996
		AU 6820594 A	12-12-1994
		CA 2162026 A1	24-11-1994
		DE 69430057 D1	11-04-2002
		DE 69430057 T2	31-10-2002
		DK 696907 T3	01-07-2002
		EP 0696907 A1	21-02-1996
		ES 2173918 T3	01-11-2002
		JP 3529780 B2	24-05-2004
		JP 8511697 T	10-12-1996
		PT 696907 T	30-08-2002
		WO 9426209 A1	24-11-1994
US 2002145139 A1	10-10-2002	AU 8728401 A	08-10-2001
		WO 0173850 A2	04-10-2001
		AU 4931101 A	08-10-2001
		WO 0173855 A2	04-10-2001
		AU 5090701 A	08-10-2001
		WO 0173770 A2	04-10-2001
		AU 4591601 A	03-10-2001
		WO 0171820 A2	27-09-2001
		AU 4768001 A	08-10-2001
		WO 0173857 A2	04-10-2001
US 2003022466 A1	30-01-2003	NONE	
US 6278102 B1	21-08-2001	JP 3049015 B2	05-06-2000
		JP 11121729 A	30-04-1999

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2004/028800	03.09.2004	05.09.2003

International Patent Classification (IPC) or both national classification and IPC
H01L31/101

Applicant
ANALOG DEVICES, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:

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NL-2280 HV Rijswijk - Pays Bas
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Fax: +31 70 340 - 3016

Authorized Officer

Boero, M

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Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was field, unless otherwise indicated under this item.

   ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).

2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ in written format

   ☐ in computer readable form

   c. time of filing/furnishing:

   ☐ contained in the international application as filed.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

Box No. II Priority

1. ☒ The following document has not been furnished:

   ☒ copy of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(a)).

   ☐ translation of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(b)).

   Consequently it has not been possible to consider the validity of the priority claim. This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43*bis*.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-20
	No:	Claims	
Inventive step (IS)	Yes:	Claims	6,13,15
	No:	Claims	1-5,7-12,14,16-20
Industrial applicability (IA)	Yes:	Claims	1-20
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V.

1 The following documents are referred to in this communication:
D1 : US 5 414 275 A (SUGAWA SHIGETOSHI ET AL) 9 May 1995 (1995-05-09)
D2 : US 5 556 423 A (CHOW ALAN Y ET AL) 17 September 1996 (1996-09-17)

2. The present application does not meet the criteria of Article 33(1) PCT, because the subject matter of claim 1 does not involve an inventive step in the sense of Article 33(3)PCT. Document D1, which is considered to represent the most relevant state of the art to the subject matter of claim 1, discloses a light conversion apparatus comprising a germanium-based photodiode and a transparent electrode that receives light and lets it pass through to the photodiode (see D1, col. 2, line 48-col. 7, line 52; fig. 2, 3a). The subject-matter of independent claim 1 differs from the disclosure of D1 in that the material used to produce the transparent electrode is a conductive oxide and not polysilicon as disclosed in the subject-matter of claim 1.
The problem to be solved by the present invention is that of providing the photodiode with an optimum transparency at the frequencies at which the photodiode is required to operate. This is an obvious requirement for all photodiodes, which could not operate if light were not to reach the photosensitive areas of the photodiode. The use of polysilicon electrodes for photodiodes is known from document D2 (see D2, col. 3, line 28-col. 11, line 12; fig. 1-4,6,8,9,11). The skilled man would know how to choose the electrode offering the best transparency for each range of frequencies at which the photodiode would be required to operate and would choose a polysilicon electrode for the types of applications in which such an electrode would offer the optimum transparency, e.g for the applications envisaged in claim 1. Therefore the subject-matter of independent claim 1 thus cannot be considered inventive (Article 33(3) PCT).

3. The same reasoning of par. 2 can be applied to independent "device" claims 8 and 16, which are also deemed to be not inventive in the sense Art. 33(3) PCT.

4. The subject-matter of claims 2-5,7, dependent upon claim 1, claims 9-12,14, dependent upon claim 8, and claims 17-20, dependent upon claim 16 is also known from D1 (see D1, col. 2, line 48-col. 7, line 52; fig. 2, 3a) and D2 (see D2, col. 3, line 28-col. 11, line 12; fig. 1-4,6,8,9,11). Therefore claims 2-5,7,9-12,14,17-20 cannot add any novel and inventive subject-matter to the independent claims upon which they depend, Art. 33(2)(3) PCT.